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SILVER BOW CREEK INVESTIGATION

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SAMPLING AND ANALYSIS PLAN
PART II: FIELD SAMPLING PLAN
FOR
SILVER BOW CREEK CERCLA SITE, MONTANA

SITE-WIDE PUBLIC HEALTH AND ENVIRONMENTAL ASSESSMENT DATA COLLECTION

EPA REGION VIII

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SAMPLING AND ANALYSIS PLAN
PART II: FIELD SAMPLING PLAN
FOR
SILVER BOW CREEK CERCLA SITE, MONTANA

SITE-WIDE PUBLIC HEALTH AND ENVIRONMENTAL ASSESSMENT DATA COLLECTION

EPA REGION VIII

Prepared by:

CH2M HILL, Inc.

July 7, 1988

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QUALITY ASSURANCE PROJECT PLAN
FOR SILVER BOW CREEK CERCLA PUBLIC HEALTH
AND ENVIRONMENTAL ASSESSMENT DATA COLLECTION

Review and Approval:

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Les Sprenger/QAO, USEPA, VIII, Denver	Date
Scott Brown/RPM, USEPA, 8MO, Helena	Date
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LIST OF ACRONYMS

CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLP	Contract Laboratory Program (EPA's)
DBMS	Data Base Management System
DVARP	Data Validation and Reduction Protocol
EMSL	Environmental Monitoring Systems Laboratory
EPA	U.S. Environmental Protection Agency
ESD	EPA's Environmental Services Division
FDF	Field Documentation Form
FIT	Field Investigation Team
FS	Feasibility Study
FSP	Field Sampling Plan
ITR	Inorganic Traffic Report
LAP	Laboratory Analytical Protocol
MDHES	Montana Department of Health and Environmental Sciences
NBS	National Bureau of Standards
NCP	National Oil and Hazardous Substances Contingency Plan (40 CFR, Part 300)
NEIC	National Enforcement Investigations Center
NPL	National Priorities List
O&M	Operations and Maintenance
PE	Performance Evaluation
PRP	Potential Responsible Party

LIST OF ACRONYMS (continued)

QAM	Quality Assurance Manager
QAO	Quality Assurance Office
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RAS	Routine Analytical Services
REM	Remedial Planning Team
RI	Remedial Investigation
ROES	Remedial Oversight Enforcement Support
RPM	EPA's Remedial Project Manager
RPTL	CH2M HILL's Remedial Planning Team Leader
RPM	EPA's Remedial Project Manager
SAP	Sampling and Analysis Plan
SAS	Special Analytical Services
SBC	Silver Bow Creek
SCS	Department of Agriculture, Soil Conservation Service
SMO	Sample Management Office (EPA's)
SMPM	State of Montana Project Manager
SOP	Standard Operating Procedure
SPM	CH2M HILL's Site Project Manager
SRM	Standard Reference Material
SSPM	Subcontractor Site Project Manager
SQAM	Subcontractor Quality Assurance Manager
USDA	United States Department of Agriculture
USGS	United States Geological Survey

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- NETSOP - 06 - Field Measurement of pH
- NETSOP - 07 - Field Measurement of Water Temperature
- NETSOP - 08 - Field Measurement of Dissolved Oxygen
- NETSOP - 09 - Sample Packaging and Shipping
- NETSOP - 10 - Field Forms
- NETSOP - 11 - Equipment Decontamination
- NETSOP - 12 - Sample Documentation
- NETSOP - 13 - QC Samples
- NETSOP - 20 - Field Measurement of Ground Water Level
- NETSOP - 23 - X-Ray Fluorescence Spectrometer (XRF) Use and Calibration
- NETSOP - 28 - Field Measurement of Redox Potential (Eh)
- NETSOP - 42 - Ground Water Sampling
- NETSOP - 44 - Soil Sample Collection and Horizon Description

1.0 INTRODUCTION AND SITE BACKGROUND

1.1 INTRODUCTION

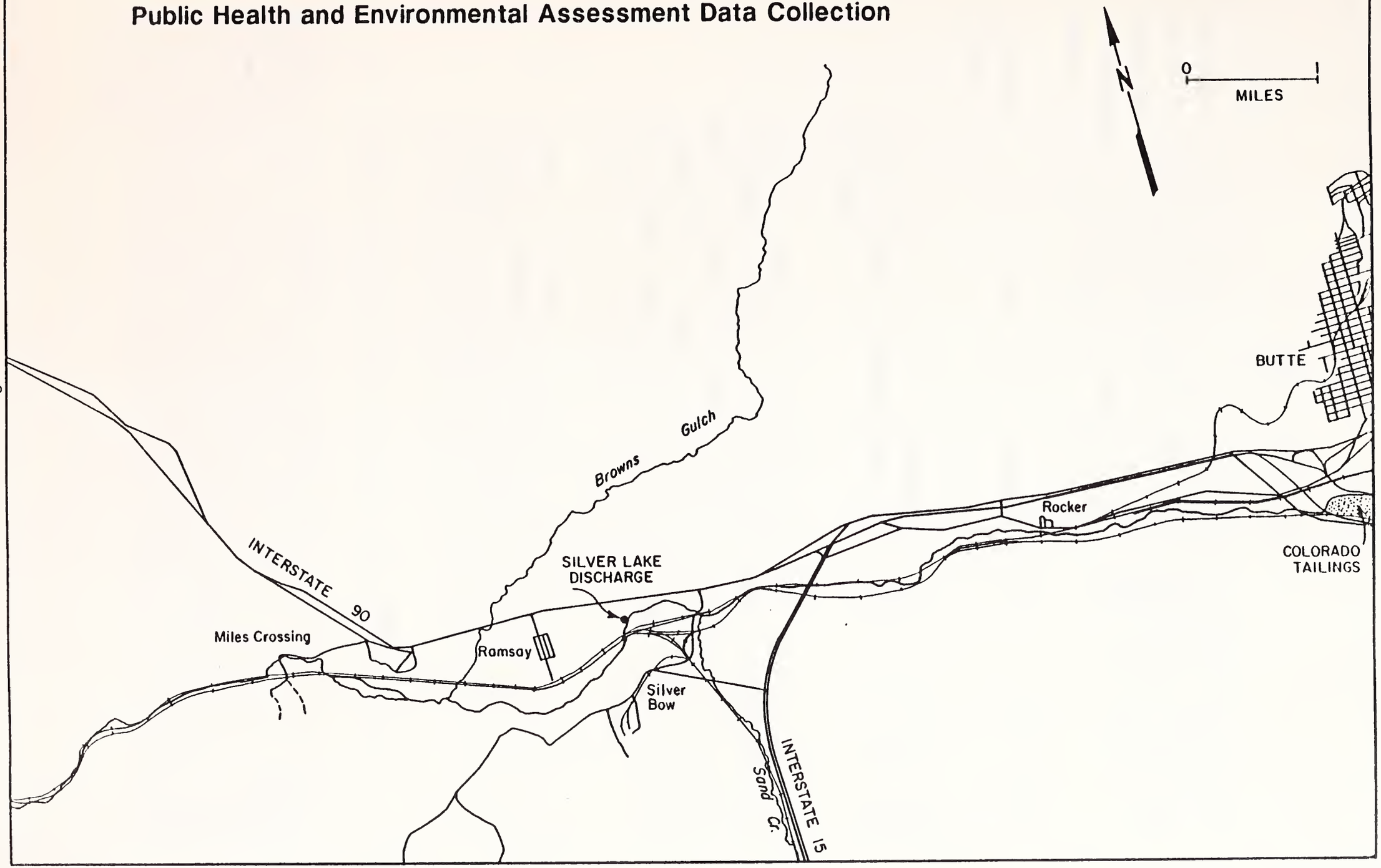
The Silver Bow Creek (SBC) CERCLA site extends from the Metro Storm Drain in Butte, Montana, to the Warm Springs Treatment Ponds and follows the course of Silver Bow Creek to its confluence with the upper Clark Fork River. Studies to be completed under this field sampling plan (FSP) will occur in the upper half of the SBC CERCLA Site (Figure 1-1). The SBC site is an extremely large and complex area. It consists of mining and associated mill wastes remaining from over 100 years of mining in the Butte area. These operations have extensively changed the area's natural environment.

1.2 SITE BACKGROUND

A summary of the history of activities at the Silver Bow Creek CERCLA Site is contained in the Part I (QAPP) of this document. Specific data needs for the sitewide Public Health and Environmental Assessment (PHEA) were identified in Technical Memorandum II (CH2M HILL, 1987). Data needs identified include soil metal analyses and complete groundwater chemistry data in populated areas between Butte and Miles Crossing. Also, background levels of inorganic parameters in soil, groundwater, and surface water which may be typical of the site before mining are to be investigated by a literature review of data from other geologically similar sites before mining. This sampling plan is designed to collect the data for the above described data needs.

Silver Bow Creek

Public Health and Environmental Assessment Data Collection



SITE MAP FIGURE 1-1

2.0 SAMPLING OBJECTIVES

The purpose of performing work tasks associated with this FSP is to provide data to be used in preparing the site-wide public health and environmental assessment for the Silver Bow Creek CERCLA site. Work tasks for this FSP and associated rationale for completing these tasks are contained in Technical Memorandum II (CH2M HILL, 1987).

The scope of work for this FSP is composed of four components which include:

- o X-ray fluorescence (XRF) screening of soils in areas near the towns of Rocker and Ramsay; obtain soils samples from areas near both towns.

- o Evaluate adequacy of existing groundwater quality data for characterizing a full suite of metals parameters (complete RAS Analysis) potentially present in the Silver Bow Creek alluvial system; obtain samples from monitoring wells at key locations along Silver Bow Creek for analysis of full suite of metals parameters if existing data are determined to be inadequate.

- o Perform literature review to determine concentrations of inorganic parameters in surface water, groundwater, and soils at sites which are geologically similar to the Silver Bow Creek site yet which are relatively undisturbed by man's activities.

- o Prepare draft and final versions of a data summary report.

The goal of soil sampling is to provide metals concentration data in populated areas which likely have the highest levels of metals contamination. The general areas around the towns of Rocker and Ramsay were selected for soil sampling because they are located down wind of known tailings deposits or other known contaminated soils. These areas are also locations with the highest population concentration near known contaminated soil areas.

The XRF screening will provide rapid and cost effective data on the relative levels of metals contamination in these two areas. Several XRF readings taken outside of these areas will be taken to provide readings from areas of lower contamination. XRF screening data from areas near the towns of Rocker and Ramsay will locate any "hot spots" which may be present.

Soil samples will then be collected from the hot spots as well as from a range of the lower concentration areas. This will allow a range of laboratory metals concentration data which can be used to estimate the soil metals concentration in the entire XRF screened area. Grain size determinations for soil samples will be performed to aid in evaluating the air entrainment potential of the soil material. The results of this screening and sampling will dictate the need for additional sampling which may be necessary.

3.0 SAMPLE LOCATION AND FREQUENCY

3.1 OVERVIEW OF SAMPLING AND MONITORING

Data to be collected in support of the Silver Bow Creek site-wide PHEA are discussed in the following sections. Data sets to be collected correspond to specific work elements outlined to fulfill the objectives of the study. A summary of the type and number of samples proposed to be collected for analysis during this investigation is presented in Table 3-1.

3.2 SCHEDULE OF OPERATIONS

The work proposed in this FSP is scheduled to cover approximately four months starting in July, 1988. This is the minimum time period necessary to evaluate existing data, collect field data, submit samples, receive analytical results, perform contract compliance screening, data validation and interpret findings of the investigation, and develop draft and final reports. The anticipated time table for completion of each work element is presented in Figure 3-1.

3.3 STUDY DESIGN

Field data collection activities associated with the Silver Bow Creek site-wide PHEA are divided into four work elements outlined below.

3.3.1 Soil XRF Screening and Sampling

Soil XRF screening will be conducted in the residential and surrounding areas of Ramsay and Rocker (Figure 1-1). XRF screening data will be used to determine "hot" spots, or areas of differential readings. The XRF survey will focus on yards, playgrounds, gardens, and other areas frequented by the local population, particularly children. The population

TABLE 3-1
SUMMARY OF SAMPLES TO BE SUBMITTED TO A LABORATORY
FOR THE PUBLIC HEALTH AND ENVIRONMENTAL ASSESSMENT

SOURCE/MEDIUM	SAMPLE TYPES NATURAL	REPS[A]	BB[B]	CCB[C]	BFS[D]	TOTAL
Rocker Residential Area/Soil	10	2	1	1	2	14
Ramsay Residential Area/Soil	10	2	1	1	2	14
SBC Alluvium Above Miles Crossing/Groundwater	4	2	1	1	2	8
TOTAL	24	6	3	3	6	36

A - Replicate Sample
B - Bottle Blank
C - Cross Contamination Blank
D - Blind Field Standard

PROJECT SCHEDULE

Silver Bow Creek
Public Health and Environmental Assessment Data Collection

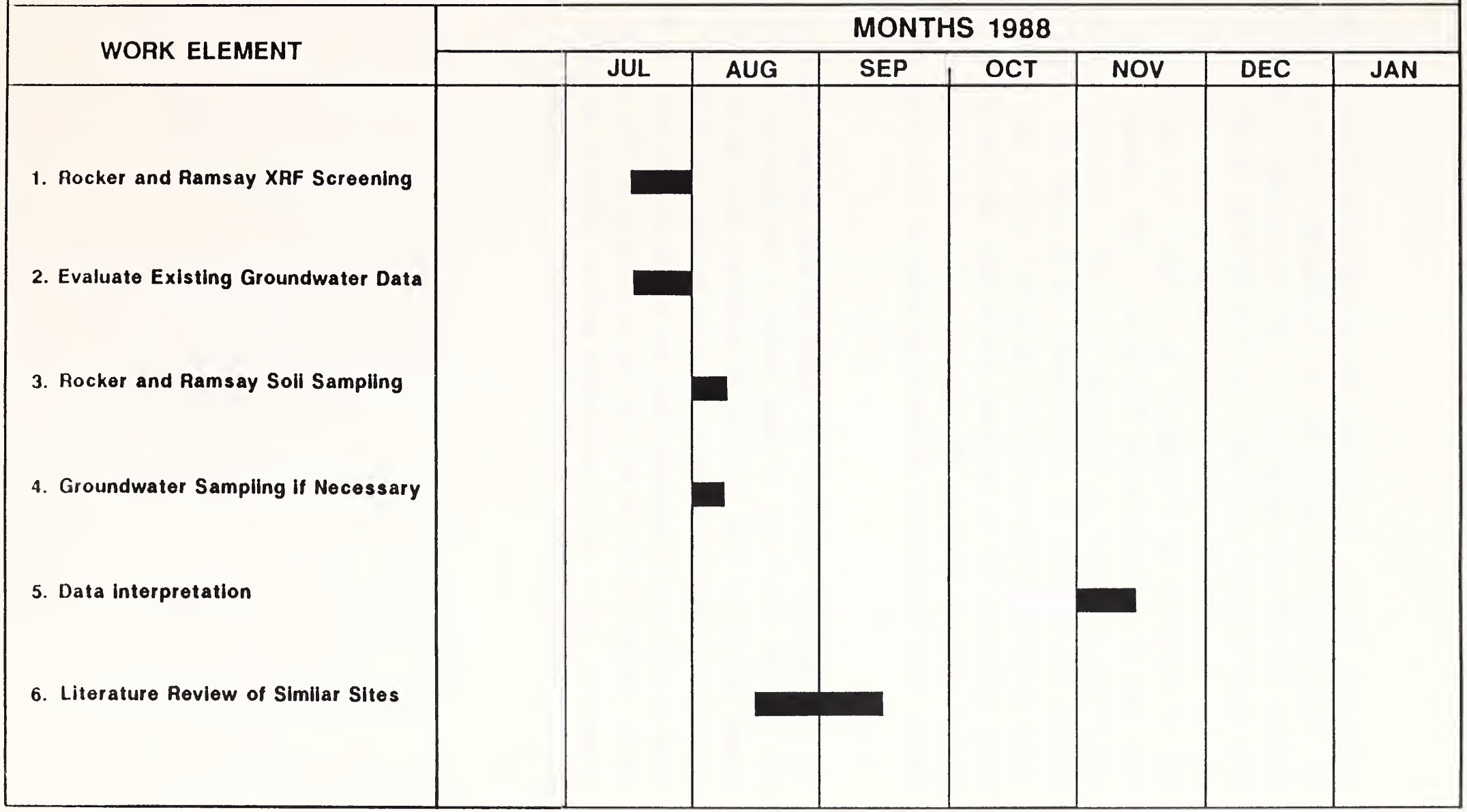


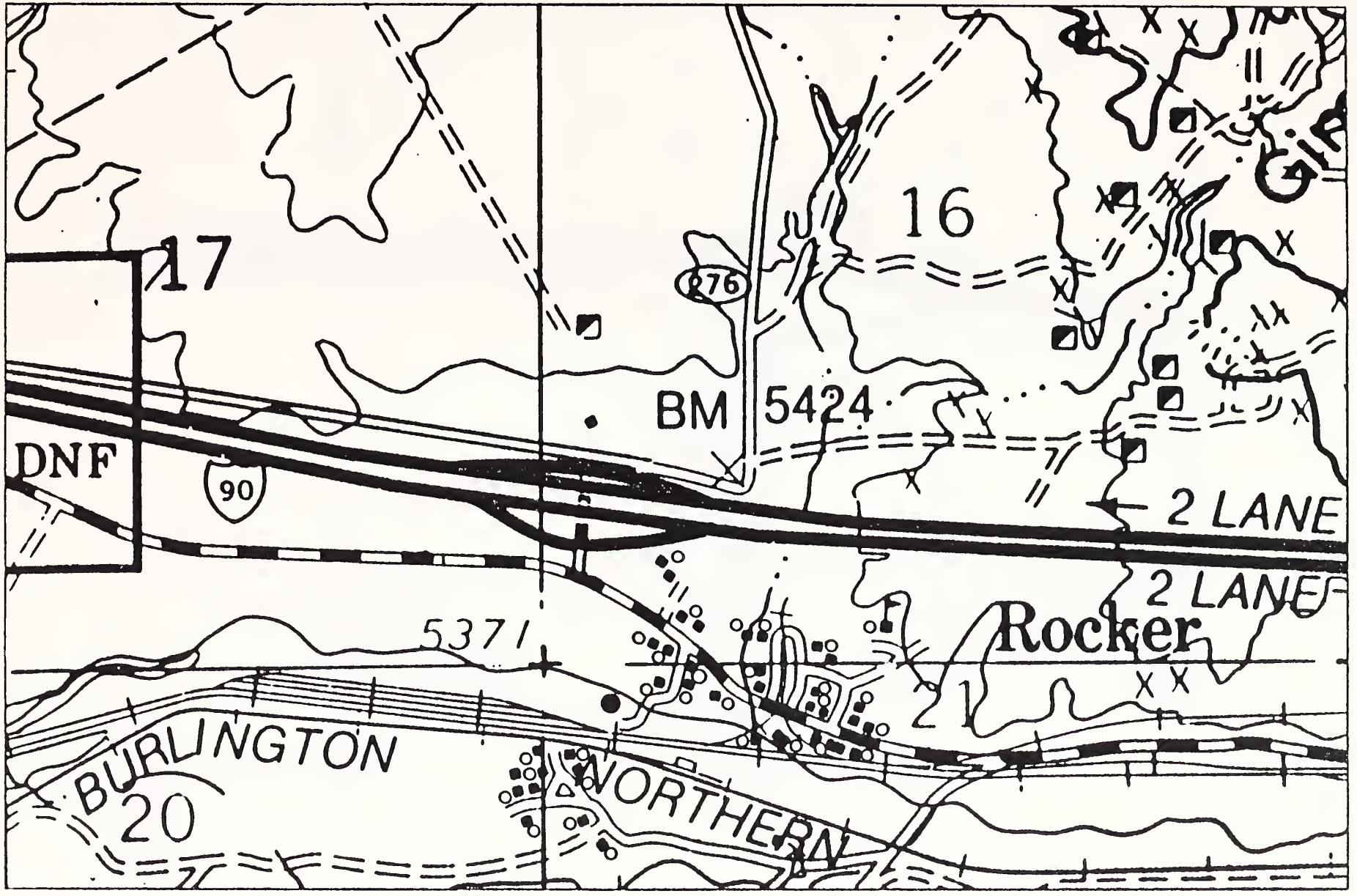
FIGURE 3-1

of Ramsay could support approximately 100 residences. If 100 residences are downwind of identified contaminant sources along Silver Bow Creek, at least 50 of these residences will be screened using the XRF (50 percent minimum screen). The 50 selected will be those most likely to trap wind blown dust and areas used by children (i.e., the ones closest to the playgrounds). Surface soil sampling at Rocker will be performed in the same manner as at Ramsay. XRF screening will be performed on at least half of the residences in Rocker. The total number of residences is anticipated to be 50 or less. At least 25 of these are to be screened and samples taken at five to ten areas, including the areas where children play. Figures 3-2 and 3-3 show the preliminary locations of XRF screening sites at Rocker and Ramsay, respectively. Several XRF readings on soil samples outside of these areas will be taken to determine "background" soil metals concentrations.

The physical dimensions of each residence or location selected for XRF screening will be measured and a sketch made in the field book of the location. XRF sites at each residence on location will be biased toward selecting sites which are observed and/or believed to be used frequently by humans. Barren areas will be emphasized over vegetated areas, but at least one vegetated area will be selected as an XRF site at each location. Areas which will likely be selected include playgrounds, play areas, driveways, dirt roads, and gardens. All XRF sites will be located on the sketch map in the field book.

Samples for XRF determinations will be collected following NET SOP-44, Soil Sample Collection and Horizon Description. At locations where especially high XRF index valves are observed, additional samples at depth (4", 8") may be taken for XRF determination to aid in delineating the depth of contamination. Samples selected for XRF analysis will be screened to the less than 2mm fraction (No. 10 Sieve) to reduce widely variable sample readings due to the presence of rock fragments. The No. 10 Sieve will be decontaminated between use by rinsing with a 2% nitric acid solution and deionized water.

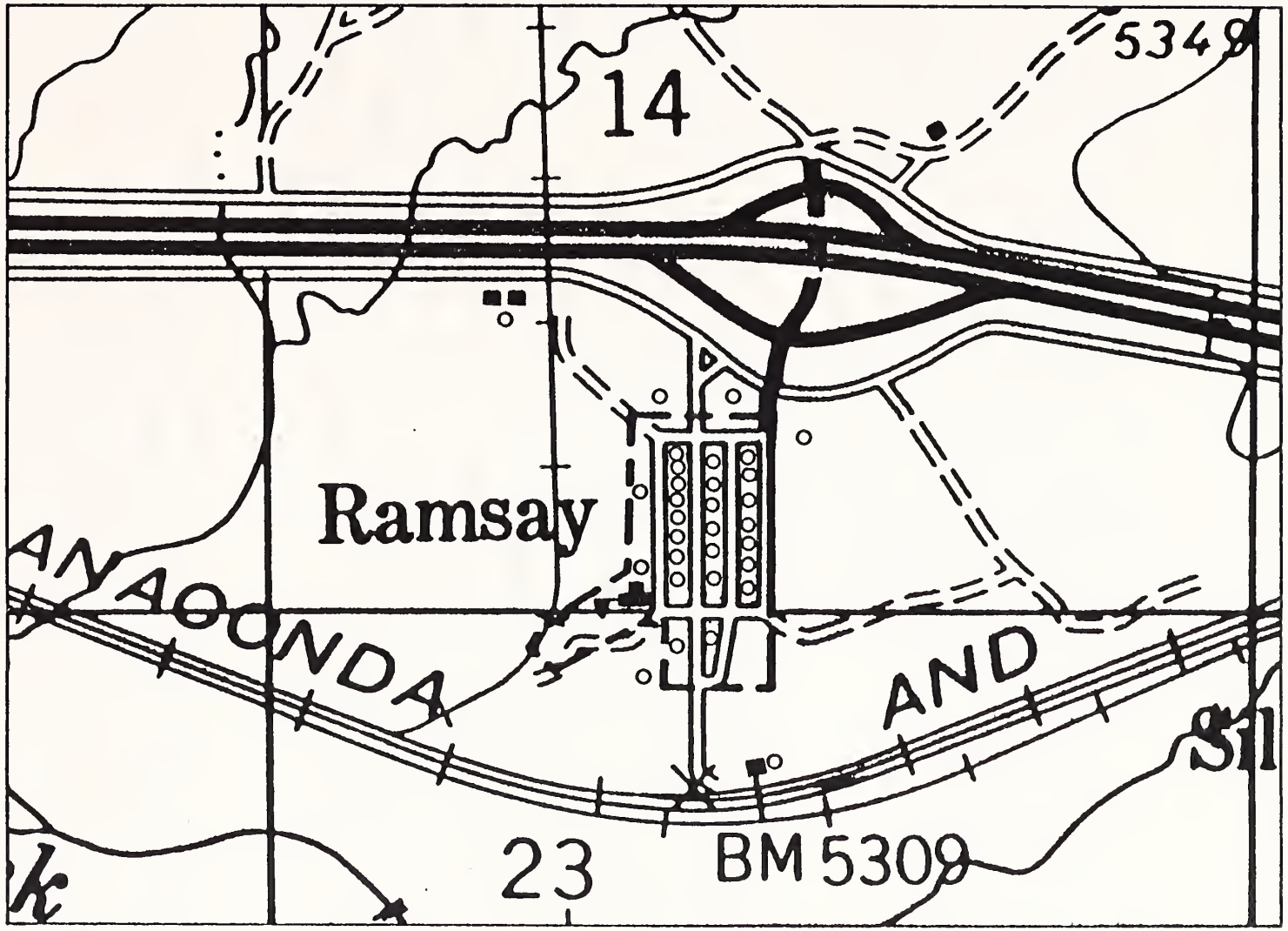
Preliminary Location of XRF Screening Sites Near Rocker, Montana
Silver Bow Creek Public Health and Environmental Assessment Data Collection



o - Preliminary XRF Screening Site

FIGURE 3-2

Preliminary Location of XRF Screening Sites Near Ramsay, Montana
Silver Bow Creek Public Health and Environmental Assessment Data Collection



o - Preliminary XRF Screening Site

FIGURE 3-3

Surface soil samples will be obtained at predetermined locations that provided a range of readings with the XRF. Samples will be taken from at least 10 percent of the areas screened with the XRF (i.e., if 50 areas are screened, it will result in five soil samples collected for laboratory analysis). Soil samples obtained for laboratory analysis will be obtained from one location. Soil sampling will be completed in accordance with NETSOP-44 (Appendix A).

Field cross contamination blanks will consist of one liter of field equipment rinsate water collected, preserved, and submitted to the laboratory for RAS-total metals analysis. Field bottle blanks will consist of DI water run directly from the field container into 1 liter poly sample bottle, preserved and submitted to the laboratory for RAS Total Metals analysis. The cross contamination and bottle blank samples will be collected at the frequency specified in the QAPP.

The exact locations of soil sampling sites cannot be shown on a map, as they will depend upon interpretation of XRF field results. If all areas provide similar XRF readings, samples will be taken in areas frequented most by children. This will provide for the most useful data given the project objectives. Soil samples will be taken from the upper one inch of the soil profile at each sample location. Table 3-1 contains a summary of sample types and quantities to be submitted for analytical testing, including QA/QC samples. Grain size determination for each soil sample submitted for laboratory analysis will be obtained by sieve and hydrometer analysis. Sieve and hydrometer analyses will be performed using standard ASTM Method D 422-63 (ASTM, 1986).

Use, calibration, and radiological safety provisions of the XRF unit is described in detail in NETSOP-23 (Appendix A). The factory or internal calibration standard will be used to provide a working field instrument calibration. Index values for spectral bands associated with selected elements analyzed by the Laboratory (As, Cu, Fe, Pb, Mn, Ni, and Zn) will be determined for natural soil samples.

Index values of Cu, Zn, Fe, Mn, Pb, As and Ni as determined by the XRF will be recorded manually on field data forms (Figure 4-5) or uploaded onto a microcomputer in the field. Necessary monitoring, sampling and safety equipment to complete the sampling effort is contained in Table 3-2.

3.3.2 Groundwater Quality Data Review and Sampling

Existing groundwater quality data for the SBC CERCLA site will be reviewed for analyses containing the complete RAS metals parameter list. If existing data do contain a full RAS suite of metals parameters, these data will be used. If existing data do not contain a full suite of metals parameters, additional samples will be taken from at least four monitoring wells located at or above Miles Crossing and complete RAS analyses will be performed.

If groundwater samples are collected, appropriate QA/QC protocol as described in the project QAPP will be observed. Table 3-3 contains a summary of sample types and quantities to be submitted for analytical testing including QA/QC samples. Necessary sampling, measurement, and safety equipment to complete the groundwater sampling effort is contained in Table 3-4. Figure 3-4 shows the location of monitoring wells which will be sampled, if necessary. Detailed sampling, field parameter measurement procedures, and documentation procedures are contained in Northern Engineering and Testing Standard Operating Procedures (NETSOP's) (Appendix A). Field measurements to be taken include; static water level, pH, SC, DO, temperature, and Eh. Groundwater samples will be field filtered (0.45u filter) and then preserved using nitric acid to lower the pH to below 2.0.

TABLE 3-2
MONITORING, SAMPLING AND SAFETY EQUIPMENT LIST FOR THE SILVER BOW CREEK PUBLIC HEALTH AND ENVIRONMENTAL ASSESSMENT SOIL SAMPLING

1 Cooler
24 ICHEM Jars - 8 ounce
EPA Sample Tags - 24
SAS Packing Lists - 1
Custody Seals - 50
Chain of Custody Records - 1
Federal Express Air Bills - 1
TLD Badges
"Fragile" and "This Side Up" Labels
Portable XRF (x-ray fluorescence analyzer) and all necessary supplies to used this instrument in the field.
First Aid Kit
Fire Extinguisher
Stretcher
Clothes Brush
Plastic Pails (for decontamination)
Plastic Water Container
Hand Soap
Paper Towels
Sharpies and Ball Point Pens
35 mm Camera
Color Print Film
Plastic Ground Sheeting to set up Decontamination if necessary
Funnel for Decontamination Water
Wind Indicator Flag (surveying tape)
Parafilm
Handiwipes
Sample Identification Matrix
Custom Field Forms
10 rubber gloves
10 garbage bags (disposable)
10 disposable dust masks
Cotton Gloves - 5 pair
Safety Glasses - 2 pair
pH Meter and Electrode
pH 4, 7 and 10 Buffer Standards
Conductivity Meter and Probe
Conductivity Standards
1000 ml Poly Beakers - 2
200 ml Poly Beakers - 2
NBS River sediment standard (BFS)
Squirt Bottles
Kimwipes
Meter Tape
Bucket Auger
Oakfield Probe
Shovels
Plastic sampling equipment and trowel
Plastic Ground Sheeting
Custom Field Report Forms
Clear Tape for Cooler Labels
Container for Kimwipes in the Field
Masking Tape (to label jars) - 1 roll
Duct Tape (for inside cooler) - 1 roll
Distilled Water (for decontamination) - 10 gallons/field collections
Thermometer (outdoor) - 1
Munsell soil color book standard SCS soil morphology code book
1 Inch Foam Rubber - 4 foot/cooler
Log Book (3 ring binder) - 1
Log Book (bound)
Site Map
Portable Water Jug (2 gal.)
Cotton Coveralls - 3
Coveralls (reusable)
Field health and safety manuals
Hard Hats - 2
Boots (steel shank and toe) - 2 pair

TABLE 3-3
SUMMARY OF GROUNDWATER SAMPLE QUANTITIES
SILVER BOW CREEK
PUBLIC HEALTH AND ENVIRONMENTAL ASSESSMENT

SAMPLE TYPE	METALS (a)
Natural Samples	4
Field Replicates	2
Field Standards	2
Bottle Blanks	1
Cross-Contamination Blanks	1

(a) Parameters include: dissolved arsenic, cadmium, copper, lead, iron, manganese, zinc, calcium, magnesium, sodium, and potassium.

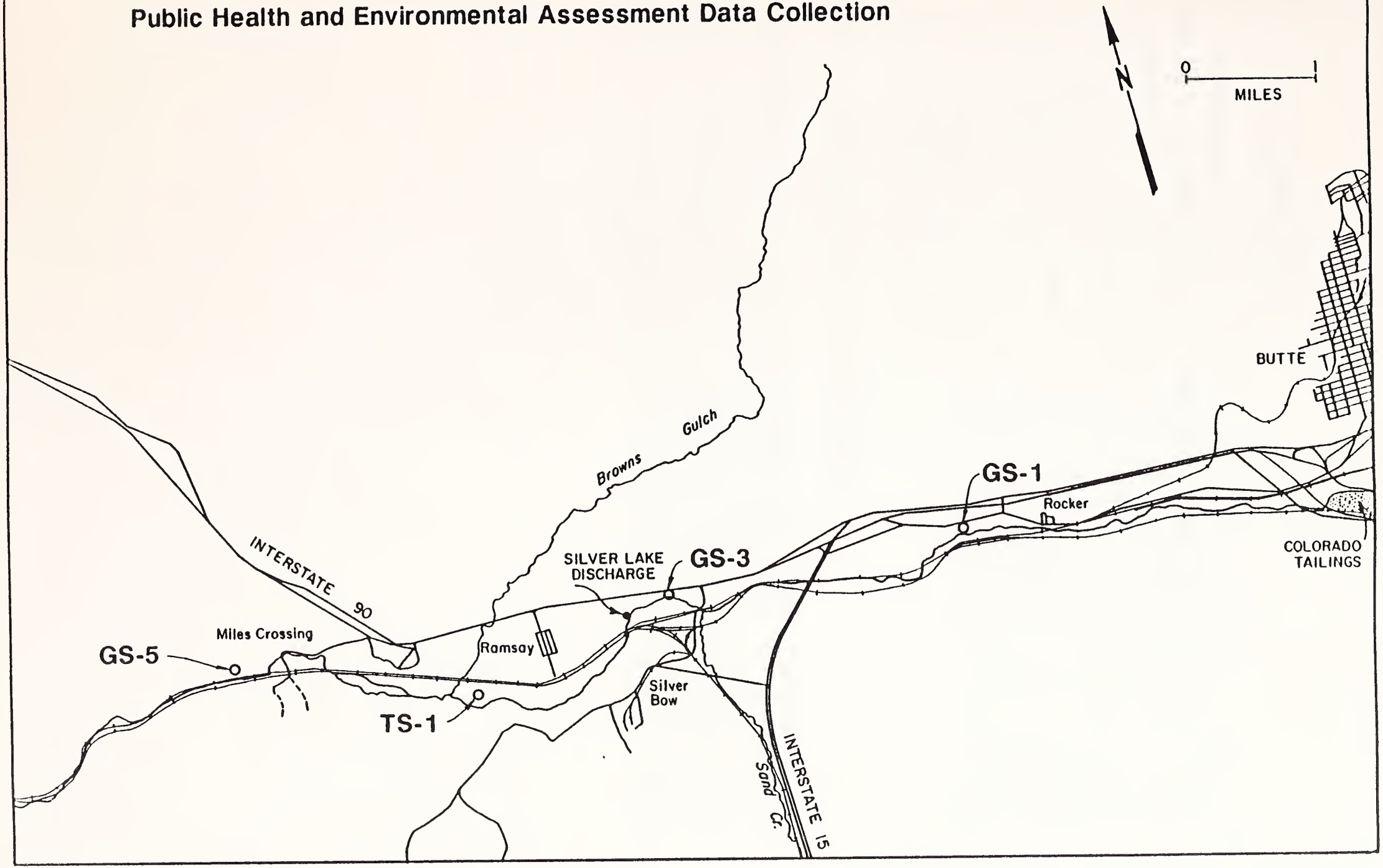
TABLE 3-4
GROUNDWATER
SAMPLING, MEASUREMENT, AND SAFETY EQUIPMENT;
SILVER BOW CREEK
PUBLIC HEALTH AND ENVIRONMENTAL ASSESSMENT

Conductivity Meter	Specific Conductivity Standards
Dissolved Oxygen Meter	Calculator
pH Meter	Paper Towels (2 rolls)
Vermiculite (1 bags; $1yd^3$)	Blue Ice (5)
pH Standards	Deionized Water (10 Gallons)
Thermometer	10% Dilute HNO_3 (2 Gallons)
Garbage Bags	Sample Bottle Checklist
Wash Basins (2)	Tool Kit
Brushes (2)	First-aid Kit
1% Liquinox (2 Gallons)	Fire Extinguisher
Squeeze Bottle (2)	Heavy Duty Ziplock Bags (25)
5-Gallon Buckets (2)	Strapping Tape
Surgical Gloves (20 Pairs)	Blankets
Rubber Gloves (6 Pairs)	Radio
USEPA QC Water Samples (3)	Gallon Plastic Bottles (2)
Indelible Ink Pens (4)	ITR Forms (24)
Sample Bottles - 1 L. (24)	EPA Forms (24)
Nitric Acid Preservative (8)	Sample ID Matrix Forms (2)
Chain-of-Custody Forms (35)	RAS Packing List (2)
Sample Custody Seals (50)	Federal Express Air Bill
Ice Chests (1)	Clear Tape; 2-inch wide
Well Probes (1)	Fragile and This Side Up Labels
	Field Filtering Apparatus

Note: Where applicable, quantities include QA/QC samples.

Silver Bow Creek

Public Health and Environmental Assessment Data Collection



MONITORING WELL LOCATIONS FIGURE 3-4

3.3.3 Literature Review

This work element involves a literature review of published and unpublished studies of concentrations of inorganic parameters in surface water, groundwater, and soils at sites which are geologically similar to the Silver Bow Creek site, yet which are relatively undisturbed by man's activities. If the literature indicates that pre-mining environmental concentrations are several orders of magnitude below measured concentrations at the Silver Bow Creek site, procurement of background samples may not be an issue at this site. If pre-mining concentrations are close to what has been measured at the Silver Bow Creek site, background samples may need to be obtained.

3.3.4 Draft and Final Data Summary Report

Subsequent to completion of the foregoing work elements, and following review of received laboratory data, a Draft Data Summary Report will be prepared containing the data and information gathered. This report will be prepared in accordance with requirements described in the project QAPP. After review of this report by appropriate agencies, a Final Data Summary Report will be prepared.

4.0 DOCUMENTATION AND FIELD OBSERVATIONS

4.1 LABELING

All samples collected will be labeled in the field using Northern Engineering and Testing's numbering and coding system. The samples will then be tagged with EPA sample tags and sealed with custody tape (Figure 4-1) and logged on chain-of-custody forms (Figure 4-2). Routine Analytical Services (RAS) forms (Figure 4-3), and Sample ID matrix (SIM) forms (Figure 4-4) will be maintained (see NETSOP-012, Appendix A).

4.1.1 Initial Labeling

All sample containers will be labeled with an indelible pen prior to being filled with water at the sampling site. The sample label will show the date, time of sampling (military time), sampler's initials, sample site number, EPA tag number, type of analysis, and preservative (if applicable).

4.1.2 Sample Numbering System

A sample numbering system will be used to identify each sample site. This system will provide a tracking number to allow retrieval and cross-referencing of sample information. A listing of sample identification numbers with written descriptions of sample location, type, dates sampled, etc., will be maintained. Each sample number will be composed of the following components:

Project Identifier -- A three-letter designation will be used to identify the site where the sample is collected. For this project, it will be SBC which stands for Silver Bow Creek.

Sample Type -- Each sample collected during the sampling program will be identified by a two-letter alpha code:

GW - groundwater sample
SO - soil sample

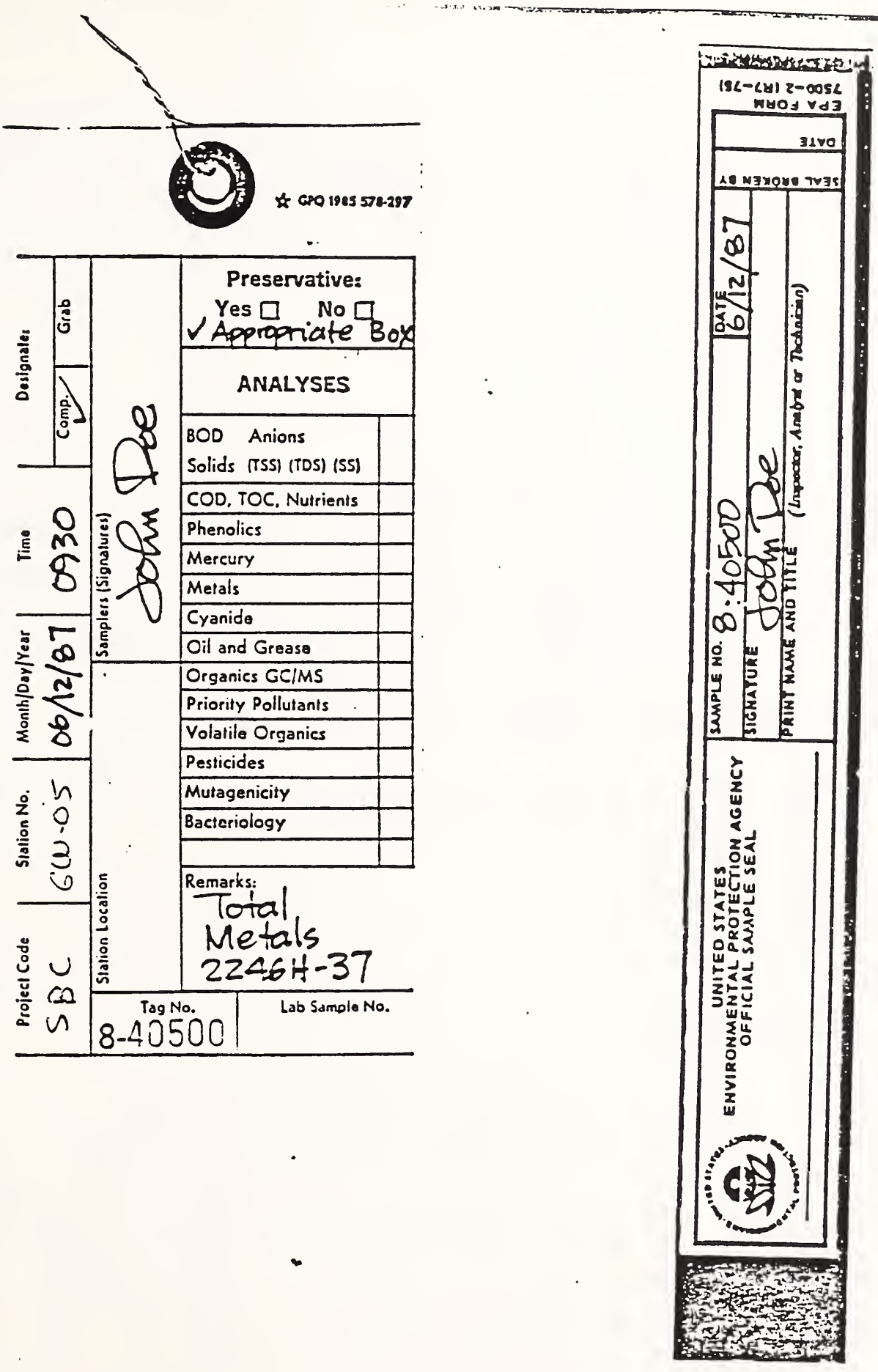


Figure 4-1. Example of EPA Sample Tag and Custody Tape.

ENVIRONMENTAL PROTECTION AGENCY
Environmental Services Division

CHAIN OF CUSTODY RECORD

REGION 8
1860 Lincoln St
Denver, Colorado

PROJ. NO | PROJECT NAME: CFR

SAMPLERS: (Signature) John Doe

STAT. NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	1 LITER POLY	1 LITER POLY ALTER/HNO3					REMARKS
GW-05	7/12/87	0930		X	Mylar Crossing	2	1	1					EPA TAG # B-40500 thru B-40503

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	

Distribution: Original Accompanies Shipment, First Copy to Coordinator Field Files, Second Copy to Representative of Inspected Facility

Split Samples — Accepted — Declined — Signature

8-1279

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Figure 4-2. Example of Chain of Custody-of Custody Forms.

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USEPA CONTRACT LABORATORY PROGRAM
SAMPLE MANAGEMENT OFFICE
P.O. BOX 818 ALEXANDRIA, VA 22313
703/557-2490 FTS-557-2490

CASE NO: | SAS NO: (IF APPLICABLE)

INORGANIC TRAFFIC REPORT
(FOR CLP USE ONLY)

TYPE OF ACTIVITY (CIRCLE ONE) ①
SUPERFUND—PA SI ESI RIFS RD RA ER
NPLD O&M OTHER _____
NON-SUPERFUND—_____PROGRAM

SITE NAME:

CITY, STATE: SITE SPILL ID:

REGION NO: SAMPLING COMPANY ②

SAMPLER: (NAME)

SHIP TO: ③

ATTN:

SAMPLING DATE: ④

BEGIN: _____ END: _____

DATE SHIPPED:_____ CARRIER: ⑤

AIRBILL NO:

SAMPLE DESCRIPTION ⑥
(ENTER IN BOX A)
1. SURFACE WATER
2. GROUND WATER
3. LEACHATE
4. SOIL
5. SEDIMENT
6. OIL (SAS)
7. WASTE (SAS)

DOUBLE VOLUME REQUIRED FOR MATRIX SPIKE/DUPLICATE AQUEOUS SAMPLE

SHIP MEDIUM AND HIGH CONCENTRATION SAMPLES IN PAINT CANS

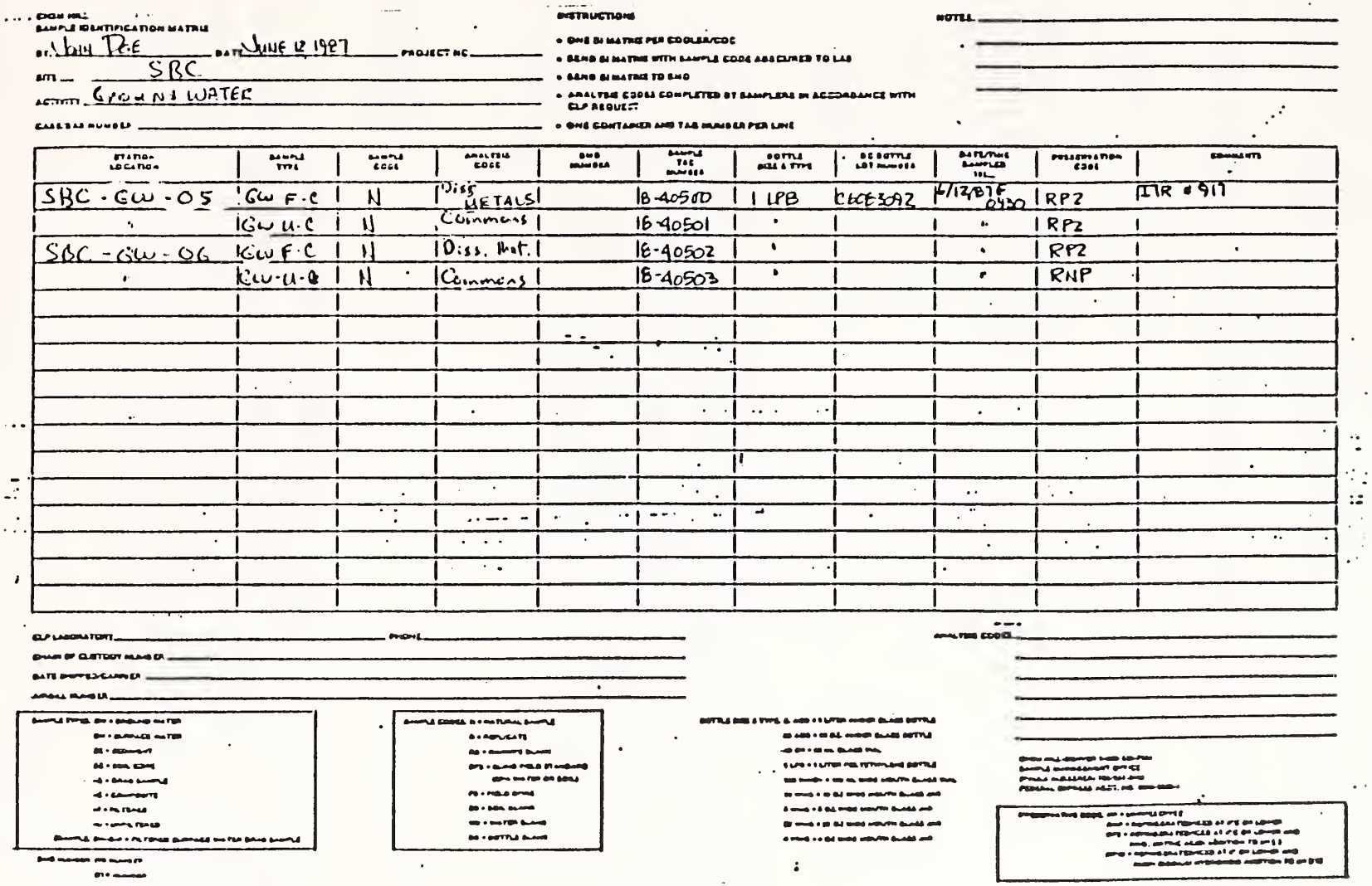
SEE REVERSE FOR ADDITIONAL INSTRUCTIONS

CLP SAMPLE NUMBER (FROM LABELS)	Ⓐ SAMPLE DESCRIPTION (FROM BOX 1) 1 2 3 4 5 6 7	Ⓑ CONCENTRATION L = LOW M = MED H = HIGH (SAS)	Ⓒ RAS ANALYSIS: TOTAL METALS	CYANIDE	DISSOLVED METALS	HIGH ONLY (SAS): SULFIDE	pH	CONDUCTIVITY	OXIDANTS	Ⓓ SPECIAL HANDLING	Ⓔ STATION LOCATION

EPA Form 2075-6 (8-87)

WHITE — SMO COPY PINK — CLIENT COPY WHITE — LAB COPY FOR RETURN TO SMO YELLOW — LAB COPY

Figure 4-3. Example of Inorganic Traffic Report Form.



SAMPLE IDENTIFICATION MATRIX

BY: John Tse DATE: June 12 1987 PROJECT NO.:

SITE: SBC

ACTIVITY: Ground Water

CASE/SAS NUMBER:

INSTRUCTIONS

- ONE SI MATRIX PER COOLER/COC
- SEND SI MATRIX WITH SAMPLE CODE ASSIGNED TO LAB
- SEND SI MATRIX TO EMO
- ANALYSIS CODES COMPLETED BY SAMPLERS IN ACCORDANCE WITH CLP REQUEST
- ONE CONTAINER AND TAG NUMBER PER LINE

NOTES:

STATION LOCATION	SAMPLE TYPE	SAMPLE CODE	ANALYSIS CODE	SMO NUMBER	SAMPLE TAG NUMBER	BOTTLE SIZE & TYPE	SE BOTTLE LOT NUMBER	SAMPLING DATE	PRESERVATION CODE	COMMENTS
SBC-GW-05	GW F-C	N	Diss METALS		IB-40500	1 LPB	CLCE3092	6/12/87 0430	RP2	ITR # 917
"	GW U-C	N	Cyanides		IB-40501	"		"	RP2	
SBC-GW-06	GW F-C	N	Diss. Met.		IB-40502	"		"	RP2	
"	GW U-C	N	Cyanides		IB-40503	"		"	RNP	

CLP LABORATORY: PHONE: ANALYSIS CODE:

NAME OF CUSTODY RECORD:

DATE SHIPPED/CARRIER:

AIRBILL NUMBER:

Figure 4-4. Example of Sample Identification Matrix Form.

Serial Number -- The third component of the sample number will be a 3-digit serial number. The serial number will be used to identify locations from descriptions written in the field log book.

Examples of the numbering system to be used for natural and QC samples are:

Natural Sample SBC-GW-GS03
Where:
SBC - Silver Bow Creek
GW - Groundwater sample
GS03 - Sample site

4.2 SAMPLE CONTROL

EPA serialized sample tags will be used to label each sample for analysis. Chain-of-custody records will be completed for all samples according to EPA requirements and will accompany sample shipment. Correctly completed custody seals will be placed on all sample containers and ice chests containing samples. Airbills will be used to ship samples to the analytical laboratory.

4.3 FIELD NOTEBOOKS

Field forms will be used for recording the data-collecting activities performed at a site (NETSOP-010, Appendix A). The forms will be numbered consecutively. Field forms will be assigned by the DCO to field crew leaders and/or to the person in charge of sampling. Field forms will remain in that person's custody during the sampling activity.

Entries on field forms will include sufficient detail to reconstruct site activities without reliance on memory. At the beginning of each entry, the date, start time, weather, field personnel present, level of personal protection, and the name of the person making the entry will be recorded. The names of visitors and the purpose of their visit also will be recorded

in the site team leader's field form. Any deviation from SOPs will also be noted. An example of the XRF field data form and groundwater sampling form are contained in Figures 4-5 and 4-6 respectively. Soil samples will be described in the site field log book.

All measurements and samples collected will be recorded. All entries will be in ink, weather permitting with no erasures. If an incorrect entry is made, the information will be crossed out with a single strike mark and initialed and dated. Whenever a sample is collected or a measurement made, a detailed description of the station location, sample identification, and type of sample will be recorded. The film roll number and number of photographs taken of the station will also be noted, when applicable. All equipment used to make measurements will be identified, including the most recent calibration date.

Samples will be collected following the SOPs documented in this plan (Appendix A). The equipment used to collect samples will be noted, along with the sampling time, sample description, and number of containers. In addition, the number of the ice chest into which the sample is placed in the field will be recorded. Sample numbers will be assigned prior to going onsite.

XRF Field Data Form

Page ____ of ____

Site I.D. _____, Samplers _____ Date/Time _____ _____

Station Location[1]	Depth		Spectral Peak Area: S	Mn	Fe	Cu	Zn	As	Pb	Ni	Comments[1]
		Index Count									
		Index Count									
		Index Count									
		Index Count									
		Index Count									
		Index Count									
		Index Count									
		Index Count									
		Index Count									
		Index Count									
		Index Count									
		Index Count									
		Index Count									
		Index Count									
		Index Count									

[1] Station Location is a four digit code: Digits 1 and 2 identify the site, digits 3 and 4 identify XRF sample location.
[2] Comments should include vegetation reference.

Figure 4-5. XRF Field Data Form.

NORTHERN ENGINEERING AND TESTING
1610 B Street, Helena, Montana (406) 443-5210

Ground Water Sampling & Measurament Form

Project: _____ Date/Time: _____
Sta. No. _____ T _____ R _____, Sec _____, tract _____
Narrative Description _____
Personnel _____
Weather _____
Type of well _____ TD _____ SWL _____
Casing _____ Inside Diameter _____ Log: Y N
Casing Stickup _____ Well Locked: Y N
Aquifer _____
Measuring Point Description _____

Meter	Serial No	Calibrated	Meter	Serial No	Calibrated
pH	_____	_____	Eh	_____	_____
SC	_____	_____	DO	_____	_____
Thermo	_____	_____	H-Scope	_____	_____

Depth to Static Water/Continuous Recorder Data

_____ ft _____ Hours DSM Reading _____
_____ ft _____ Hours DSM Reading _____
_____ ft _____ Hours DSM Reading _____
Chart or Chip Removed: Y N Replaced: Y N

Well Evacuation

Bore volume: 1/25 x (TD-SWL) x $(dia)^2$ = _____ gallons
Well Evacuation Method _____
Remarks _____

Evacuation Data

SC	pH	DO	Time	Gallons	Rated

STA. NO. _____

Well Sampling Method _____
Decontamination Code (See page 1 of booklet) A B

Specific Conductance Temperature Correction Table

Temp	Factor	Temp	Factor	Temp	Factor	Temp	Factor
-1	1.89	8	1.46	17	1.18	26	0.98
0	1.84	9	1.42	18	1.15	27	0.96
1	1.79	10	1.38	19	1.13	28	0.94
2	1.74	11	1.35	20	1.10	29	0.92
3	1.68	12	1.32	21	1.08	30	0.90
4	1.63	13	1.29	22	1.06	31	0.88
5	1.58	14	1.26	23	1.04	32	0.86
6	1.54	15	1.23	24	1.02		
7	1.50	16	1.20	25	1.00		

Sample Data

Water Temp. (1)	Observad SC(umhos) (2)	Temp. Correction Factor (3)	Cell Factor Above (7)	Sample SC=(2)x(3)x(7) (umhos/cm @ 25°c)

FIELD DATA

Water Temperature _____ (°C) SC _____ (umhos/cm @ 25°C)
Diss. Oxygen _____ (mg/L) pH _____ (Standard Litars)
S. W. L. _____ (ft) Eh _____ (millivolts)
Water Quality Samplas: Y N Chain of Custody: Y N

Bottle	Paramatars	Preservativa

Lab _____ Analysis Request Form: Y N
Desc. of Water: Start _____ Finish _____

Figure 4-6. Groundwater Sampling Field Form.

5.0 SAMPLING EQUIPMENT AND PROCEDURES

Standard Operating Procedures (SOPs) for all sampling and field measurements to be performed in this data collection effort are contained in Appendix A. Equipment which will be used and decontamination procedures are also contained in Appendix A.

6.0 PROJECT PERSONNEL

Field personnel from Northern Engineering and Testing and their responsibilities associated with the Silver Bow Creek public health and environmental assessment data collection tasks are presented below.

- Subcontractor Site Project Manager: Myles Grotbo
- Field Crew Leader: David Hazen, Marshall Corbett
- Document Control Officer: Sally Staley
- Safety Officers: David Hazen
- Field Scientists: David Hazen, Marshall Corbett, Brian Grant

Responsibilities of the individuals presented above are as follows:

- Subcontractor Site Project Manager - serves as principle investigator; responsible for technical development and overall management of study.

- Field Crew Leader - responsible for field data collection at the crew level including equipment and materials procurement, problem solving in the field, and sampling logistics.

- Document Control Officer - responsibilities are to: 1) ensure data and documents are released and distributed in accordance with EPA requirements; 2) ensure data, documents and samples are kept secure, under custody when necessary; and (3) ensure document or data holders are known.

- Safety Officers - ensure that the site safety plan is implemented and enforced. Procure appropriate and adequate safety equipment for field crew.

7.0 SAMPLE CONTAINERS, PRESERVATION, AND SHIPPING

7.1 SAMPLE CONTAINERS

Packaging of soil samples is discussed in NETSOP-24 (Appendix A). All collected water samples will be stored in one-liter narrow mouthed polyethylene I-CHEM bottles. Soil sampled will be collected and stored in 8 oz. I-CHEM glass bottles. All will be placed in ziplock bags and packed in ice chests. NETSOP-9 (Appendix A) describes sample packing and shipping procedures.

7.2 SAMPLE PRESERVATION

Groundwater samples will receive chemical preservations as indicated in Table 7-1 for each separate portion of the sample. Soil samples will not receive preservation.

7.3 SAMPLE SHIPPING

All transport and shipping of samples will be conducted under strict chain-of-custody. A laboratory has not been assigned prior to FSP development. Sealed coolers will be archived in a designated, secure storage facility in the event a contract laboratory is not assigned once field work begins. A paperwork audit on the samples prior to laboratory shipment will be performed before shipment. The original shipping document always accompanies the shipment. All other copies are delivered to the Site Project Manager under strict chain-of-custody.

TABLE 7-1
BOTTLES, PRESERVATIONS, AND SHIPPING REQUIREMENTS

Sample Type	Assumed Concentration	Type[a] Analysis	Container Filling	Preservation	Shipping
Water samples for dissolved metals	Low to Medium	1	One 1-liter polyethylene bottle/ fill approximately one-quarter full.	HNO_3 to pH <2 Iced to 4°C	Federal Express Priority 1
Soil samples	Low to Medium	2	One 8 oz. I-CHEM Glass Bottle	None	Federal Express Priority 1

[a] Type of Analysis: 1 = Oissolved Metals (Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, V, Zn)
2 = Total Metals, CLP Parameter List

7.4 SAMPLE ARCHIVE

While it is not intended to acquire archive samples during field sampling, it is requested that extra soil sample remaining after lab analysis be stored for 60 days after all results have been reported. This will allow CH2M HILL at least 60 days to review results and to request reanalysis if necessary. At the end of this time period, all disposition of the samples shall be at the direction of CH2M HILL.

8.0 HEALTH AND SAFETY

The subcontractor Site Health and Safety Officer will ensure that the subcontractor Site Health and Safety Plan is properly implemented. A Health and Safety Plan in conformance with applicable State and Federal regulations shall be implemented by each subcontractor.

Radiation exposure from the XRF will be monitored by a monthly film badge service.

9.0 REFERENCES

ASTM, 1986. Annual Book of ASTM Standards, Section 4, Construction, Volume 04.08. American Society for Testing and Materials, 1986.

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U.S. Environmental Protection Agency, 1986a. Guidelines for Estimating Exposure. Federal Register. Vol. 51 34042-34005. September 24, 1986a.

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APPENDIX A

SILVER BOW CREEK PUBLIC HEALTH AND ENVIRONMENTAL ASSESSMENT FIELD WORK

STANDARD OPERATING PROCEDURES

(Numbers Are Not Sequential)

NORTHERN ENGINEERING AND TESTING'S
STANDARD OPERATING PROCEDURE
FIELD SAMPLE FILTRATION

1. Filtration apparatus will be decontaminated in accordance with NETSOP-011.

2. Visually inspect filtration equipment for damage. Replace parts or repair equipment as necessary.

3. Place 10-15 milliliters of 10% dilute nitric acid into filter apparatus containing 0.45 micron filter. Apply vacuum, discard filtered solution.

4. Repeat above procedure three times using sample water. Discard filtrate. If unable to repeat three times, use a pre-filter before using the .45 micron filter.

5. Fill filter vessel with sample water and apply vacuum. Use small quantities of filtered water to rinse sample container three times.

6. Fill sample container to appropriate level with filtered sample and mark level with permanent marker. Add appropriate preservative, if necessary. Invert sample container several times to insure complete sample - preservative mixing.

7. Place sample container into cooler; package and ship in accordance with NETSOP-009.

8. If extremely turbid sample water is obtained, use same procedure utilizing pre-filter (usually 3.0 micron) followed by 0.45 micron filtration.

NORTHERN ENGINEERING AND TESTING'S
STANDARD OPERATING PROCEDURE
FIELD MEASUREMENT OF SPECIFIC CONDUCTANCE

Field Procedure

1. Check red line and zero point on meter. Adjust as necessary.

2. Rinse decontaminated glass beaker with approximately 50 milliliters of sample water three times.

3. Place water sample in decontaminated glass beaker.

4. Rinse probe with DI water and place conductivity probe in sample water.

5. Immerse conductivity probe in sample so that vent hole is submerged. Move probe around in sample to displace any air bubbles. Turn instrument on to appropriate scale for sample analyzed. Multiply reading by the correct multiplier from the dial and record to the nearest ten micromhos/centimeter. Measure sample temperature to nearest $0.5^{o}C$ from conductivity meter. Record temperature after temperature has equilibrated.

6. Remove probe from sample and rinse probe with DI water.

7. Corrected SC values are obtained by multiplying the instrument SC value by the temperature correction factor and then by the cell constant.

Instrument Calibration

At the beginning and end of each day of sampling, determine cell constant in the field.

1. Rinse probe with deionized water.

2. Measure conductivity of two KCl solution standards which bracket expected sample values.

3. Measure temperature of both KCl solution standards.

4. Calculate cell constant for each standard and average the two values. The cell constant is the ratio of the computed conductivity to the measured conductivity of the standard KCl solution. Use this averaged constant and measured field temperatures and conductivities to calculate conductivity at $25^{o}C$ for each sample taken during the day.

Monthly Calibration Procedure

1. The conductivity meter and cell response to known standards throughout the range of measurement are observed and graphed.

2. If a linear response is observed two calibration standards can be used in the field.

3. If a nonlinear response is observed, more than two field calibration standards will be necessary in the field.

Maintenance

1. Store meter in its case during transport. If stored for long periods of time, immerse probe in distilled water.

2. Check batteries before taking meter into the field. Carry spare batteries and screwdriver.

3. Inspect conductivity electrodes on a monthly basis for cracks or other damage.

4. If platinum black has flaked off, a sharp end point cannot be achieved or readings are erratic. Return probe to factory so it can be replatinized.

Example calculation - corrected Specific Conductivity -

Instrument Reading = 570
Temperature = 11°
Temperature Correction = 1.35
(See table below)
Cell factor = 1.05
(See example below)

Corrected SC value at 25 = 570 x 1.35 x 1.05
= 808

Example Cell Factor Calculation:

Date & Time (1)	SC of Standard (umhos/cm @ 25° C) (2)	Temp of Standard (3)	Instrument Reading (4)	Temp Corr. Factor (5)	Temp. Corrected SC (4)x(5) (6)	Cell Corr. Factor (2):(6) (7)	Cell Corr. Factor Average (8)
1/5/88	147	6°	95	1.54	147	1.00	1.02
1300	1413	7°	910	1.50	1365	1.04	

SPECIFIC CONDUCTANCE TEMPERATURE CORRECTION TABLE

Temp	Factor	Temp	Factor	Temp	Factor	Temp	Factor
-1	1.89	8	1.46	17	1.18	26	0.98
0	1.84	9	1.42	18	1.15	27	0.96
1	1.79	10	1.38	19	1.13	28	0.94
2	1.74	11	1.35	20	1.10	29	0.92
3	1.68	12	1.32	21	1.08	30	0.90
4	1.63	13	1.29	22	1.06	31	0.88
5	1.58	14	1.26	23	1.04	32	0.86
6	1.54	15	1.23	24	1.02		
7	1.50	16	1.20	25	1.00		

NORTHERN ENGINEERING AND TESTING'S STANDARD OPERATING PROCEDURE FIELD MEASUREMENT OF pH

Field Procedures

1. Rinse decontaminated glass beaker with approximately 50 milliliters of sample water three times.

2. Rinse pH and temperature compensating electrodes with deionized water.

3. Check meter using standard that is nearest the expected pH. If not within 0.1 pH units re-calibrate meter using appropriate standards.

4. Fill beaker with sample water.

5. Immerse electrodes in sample while swirling the sample to provide thorough mixing. Turn on meter. Electrode filler level should be 1/2-inch above sampling surface level. Read pH to nearest 0.1 unit once the reading is stabilized.

6. Record sample pH. Note any problems such as erratic readings.

7. Rinse probes with DI water and store according to manufacturer's directions.

Instrument Calibration

1. Calibrate pH meter in the field at the beginning of each day of field work when pH will be measured, or when the standard check is out of acceptable bounds. Calibrate using following procedure:

    - Rinse pH and temperature compensating electrodes with distilled water.

    - Immerse electrodes in beaker of commercial calibration solution of pH at or below that expected for the samples.

    - Calibrate meter to appropriate pH.

    - Remove electrodes from solution, rinse with distilled water, air dry.

    - Immerse electrodes in second calibration solution having a pH 2 to 3 units higher or lower than the first, calibrate meter to solution.

- Measure pH of one of the calibration solutions. If measured value differs from expected value by more than 0.1 units, obtain fresh calibration solutions and recalculate. If discrepancy persists, begin trouble-shooting procedures following meter operating instructions: check batteries, connections, etc. If meter checks out, inspect combination electrode. Clean and refill as necessary.

Maintenance

1. Store meter in its case with pH electrode immersed in a pH 7 buffer solution.

2. Inspect electrode weekly.

   - Plug of filler hole should be firmly seated when meter is stored for a week or more.

   - Check glass electrode for cracks or scratches.

3. Check batteries each time meter is used. Carry a spare battery pack and a screwdriver into the field in the pH meter case.

4. Check pH meter monthly with a pH meter tester and adjust as necessary.

NORTHERN ENGINEERING AND TESTING'S
STANDARD OPERATING PROCEDURE
FIELD MEASUREMENT OF WATER TEMPERATURE

1. Carry two NBS-calibrated thermometers inside cases, into the field.

2. Check thermometer for cracks or gaps in the mercury. Do not use thermometers if either cracks or gaps are visible.

3. When possible, measure temperature of surface water at midstream submersing the thermometer for approximately one minute or until temperature stabilizes.

4. When in situ temperature measurements are not possible, draw sample of at least 200 mL into a decontaminated beaker or sample bottle as soon after sampling as possible.

5. Place thermometer in sample. Do not allow thermometer bulb to touch sides of beaker. Allow to equilibrate (about 1 minute).

6. Record temperature to nearest $0.5^{o}C$ in field log book or on field data sheet.

7. On a quarterly basis, check field thermometers against NBS-calibrated laboratory thermometer. Agreement should be within $0.5^{o}C$.

NORTHERN ENGINEERING AND TESTING'S
STANDARD OPERATING PROCEDURE
FIELD MEASUREMENT OF DISSOLVED OXYGEN

1. Inspect dissolved oxygen (DO) meter for damage - repair as necessary.

2. Rinse probe and cable with DI water.

3. Prepare probe and DO meter in accordance with instrument manufacturer's operating procedures. Make certain probe contains sufficient electrolyte and the oxygen sensor membrane is in good repair.

4. Calibrate probe and meter using the fresh water - air calibration method. Correct calibration value for temperature and altitude; adjust meter accordingly.

5. When possible place probe directly into the stream if not possible, place probe into beaker filled with sample. Manually raise and lower probe through sample about 1 foot/second. Allow sufficient time for probe to stabilize to sample temperature and dissolved oxygen concentration.

6. Read dissolved oxygen value. Record appropriate data on field forms.

NORTHERN ENGINEERING AND TESTING'S
STANDARD OPERATING PROCEDURE
SAMPLE PACKAGING AND SHIPPING

All water samples collected should be packaged and/or shipped utilizing the following procedures.

Packaging

1. Place labelled sample bottles in a zip lock bags and then in a high quality cooler containing two large containers of recently frozen blue ice, making sure the cooler drain plug is taped shut both inside and outside.

2. Position the sample bottles upright and surround the samples with noncombustible, absorbent, cushioning material for stability during transport.

3. Place the laboratory/sampling paperwork in a ziplock bag and tape it to the inside lid of the shipping container (see Shipping Papers).

4. Close and seal the cooler with at least two signed and dated custody seals and sealer tape. Tape cooler shut utilizing fiberglass tape.

5. Secure Air Bill to cooler and ship via express air service.

6. Notify project manager of shipment.

Marking/Labeling

7. Use abbreviations only where specified.

8. Place the following information either hand printed or in label form, on the outside container:

   - Laboratory name and address (on Air Bill)

   - Return cooler to: (name and address)

9. Secure "This End Up" and "Fragile" stickers clearly on top of the shipping container. Put upward pointing arrows on all four sides of the container. No other marking or labeling is required.

Shipping Papers

10. No DOT shipping papers are required. All field samples, (natural and QC), will be documented with the following forms. These forms will be placed in ziplock bags and taped to the inside lid of the same cooler as the samples to which they pertain.

    - o Chain-of-custody form
    - o Special Analytical Service
    - o Sample matrix form

NORTHERN ENGINEERING AND TESTING'S STANDARD OPERATING PROCEDURE FIELD FORMS

All pertinent field survey and sampling effort information shall be recorded on a field form during each day of the field effort and at each sample site. The field crew leader shall be responsible for ensuring that sufficient detail is recorded on the field forms. No general rules can specify the extent of information that must be entered on the field form. However, field forms shall contain sufficient information so that someone can reconstruct all field activity without relying on the memory of the field crew. All entries shall be made in indelible ink weather conditions permitting. Each day's or site's entries will be initialed and dated at the end by the author. All corrections shall consist of line-out deletions which are initialed.

At a minimum, entries on the field sheet shall include:

- Date and time of starting work and weather conditions.
- Names of field crew leader and team members
- Project name or type
- Description of site conditions and any unusual circumstances.
- Location of sample site, including map reference, if relevant
- Equipment ID numbers
- Details of actual work effort, particularly any deviations from the field operations plan or standard operating procedures
- Field observations
- Any field measurements made (e.g., pH)

For sampling efforts, specific details for each sample should be recorded. In addition to the items listed above, the following general information should be included on the field form during sampling efforts:

- Type and number of samples collected
- Sampling method, particularly deviations from the operating procedures

Strict custody procedures shall be maintained with the field forms utilized. While being used in the field, field forms shall remain with the field team at all times. Upon completion of the field effort, field forms shall be filed in an appropriately secure manner in Northern's Helena office. Photocopies of the original field forms will be used as working documents.

NORTHERN ENGINEERING AND TESTING'S STANDARD OPERATING PROCEDURE EQUIPMENT DECONTAMINATION

The purpose of this section is to describe general decontamination procedures for field equipment in contact with mine/mill tailings, soil, or water. During field sampling activities, sampling equipment will become contaminated after it is used. Sampling equipment must be decontaminated between sample collection points if it is not disposable.

Field personnel must wear disposable examination gloves while decontaminating equipment at the project site. Every precaution must be taken by personnel to prevent contaminating themselves with the wash water and rinse water used in the decontamination process. Protective safety glasses shall be won when using acid.

Table A-1 lists equipment and liquids necessary to decontaminate field equipment.

The following should be done in order to ensure thorough decontamination:

1. Set up the decontamination zone approximately 15 feet upwind from the sampling area. This area will be designated by the field crew leader.

2. Visually inspect sampling equipment for contamination; use stiff brush to remove visible material.

3. The general decontamination sequence for field equipment includes: wash with Liquinox or its equivalent; DI water rinse; dilute nitric acid rinse; DI water rinse; rinse with sample water three times.

4. Rinse equipment with hexane solution if sampling for organic contamination. Follow with a DI water rinse.

All disposable items (e.g., paper towels, examination gloves, wash cloths) should be deposited into a garbage bag and disposed of in an approved landfill. Contaminated wash water does not have to be collected.

If vehicles used during sampling become contaminated, wash both inside and outside as necessary.

TABLE A-1. EQUIPMENT LIST FOR DECONTAMINATION

2-gallon plastic tubs	Liquinox (soap)
2-gallon pressurized garden sprayer	Hard bristle brushes
5-gallon plastic water-container	Garbage bags
5-gallon carboy DI water	Latex gloves
1-gallon cube of 10% HNO_3	Squeeze bottles
Paper towels	

NORTHERN ENGINEERING AND TESTING'S
STANDARD OPERATING PROCEDURE
SAMPLE DOCUMENTATION

The purpose in filling out field documents is to provide enough information to reconstruct the sampling event without relying on the memories of the field crew. It is the responsibility of the DCO to assure field documents contain sufficient detail, and are correct. All entries will be made in indelible ink weather conditions permitting and all corrections will consist of initialed line-out deletions.

Complete and accurate sample documentation is essential for Level B criteria. The responsibility of the document control officer will be to meet the Level B goal.

Documents to be completed for each sample generated during the Screening study are:

- Northern Engineering and Testing's Field Form
- Chain-of-Custody Form
- EPA Sample Tags
- Custody Seal
- SAS Packing Lists
- Sample Identification Matrix Forms
- Organic Traffic Report (if applicable)
- Inorganic Traffic Report (ITR) form (if applicable).

Responsibility for the completion of these forms will be with each field crew leader.

Photographs and a photo log will be completed of each soil sample collected for laboratory analysis.

NORTHERN ENGINEERING AND TESTING'S
STANDARD OPERATING PROCEDURE
QC SAMPLES

QC samples do not have any unique identifying codes that would enable the contract lab or others to bias these samples in any way. There are, however, differences in blank and standard samples which might separate them from the rest of the sample train. The sampling team will strive for uniformity in sampling technique to limit sampling error. The QC samples will be identified only on the SAMPLE IDENTIFICATION MATRIX. The codes on the matrix sheet are as follows.

N - Natural Sample
R - Replicate - Duplicate Sample
BB - Bottle Blank
WB - Cross Contamination Blank
BFS- Blind Field Standard
S - Split Sample
KB - Kimwipe Blank
TB - Travel Blank

In general, QC samples will be inserted into the sample train on a one in twenty basis or one per day per sampling crew, whichever results in more QA/QC samples (one in twenty for soils or sediment sampled).

1. A duplicate sample will be a second sample taken at a site.

2. A bottle blank will be deionized water placed directly into the sample bottles with preservative as required.

3. A cross contamination blank will be deionized water run through all sampling equipment or a Kimwipe wiped over decontaminated equipment and then placed into sample bottles.

4. A field standard will be an EPA approved standard prepared in the laboratory and entered into the sample train.

5. A split sample will be obtained for shipment to a separate laboratory for analysis. These samples are collected typically on a one in ten basis.

6. A Kimwipe blank will be a Kimwipe obtained directly from its packaging and inserted into a sample container.

7. When organic constituents are sampled, a travel blank shall be prepared and included with the sample train. A travel blank will be a deionized water sample prepared at the analytical laboratory and shipped to the sampling team; the blank must travel in a cooler with the collected samples.

Each field crew leader will be responsible for all QC samples prepared by that crew.

NORTHERN ENGINEERING AND TESTING'S
STANDARD OPERATING PROCEDURE
FIELD MEASUREMENT OF GROUND WATER LEVEL

1. Check well probe prior to leaving for field for defects. Repair as necessary. Make certain the well probe, a decimal tape measure and extra batteries are in the carrying case.

2. Measure all wells (monitoring and domestic) from the top of the well casing on the north side or from a designated measuring point, as appropriate.

3. Obtain a depth to water from measuring point to the nearest hundredth of a foot. Record data on appropriate field forms.

4. Decontaminate well probe between each measurement by scrubbing with Liquinox and brush, then rinsing with deionized water.

5. Calibrate well probe to a steel tape prior to and following each data gathering episode. Note any corrections to well probe measurements on field forms. Adjust reported data as necessary.

NORTHERN ENGINEERING AND TESTING'S
STANDARD OPERATING PROCEDURE
X-RAY FLUORESCENCE SPECTROMETER (XRF) USE AND CALIBRATION

GENERAL

The chemical characterization of soil samples in the field will be determined by the field portable X-ray fluorescence (XRF) Spectrometer ATX-100 instrument manufactured by Aurora Tech, Inc, 331 Rio Grande Street, Salt Lake City, Utah. The instrument uses low level self-contained and shielded radioactive sources that produce spectral peaks whose position (energy level) is specific to an individual element and whose peak height or area which is indicative of the concentration of that element within the area exposed to the source. A cadmium-109 (15 millicuries) source and Iron-ss (100 millicuries) source implaced by the manufacturer will be used. This source will allow semiquantitative determination of the copper, zinc, arsenic, iron, nickel, manganese and lead concentrations.

The detection limit for each parameter is a function of source strength, geometry/particle size, counting time, and the concentration of other elements. Since the source strength and instrument geometry are constants, the detection limit is dependent on geometry/particle size, counting time, and concentration. It has been demonstrated that 80 mesh particle size dominantly composed of a siliceous or calcareous skeletal matrix will give analytical results within 20 percent. The larger the particle size, the larger the error. A rock made up of fine-grained minerals, however, will essentially have the same precision and accuracy as a finely ground sample. Soil samples will be screened and all particles greater than 2 mm (No. 10 sieve) will be removed.

The counting time also affects the detection limit. In general, the longer the counting time, the lower the detection limit, and the higher the precision and accuracy. The instrument has controllable time units of 10, 30, 100, 300, and manual control seconds. The 30 second counting time will likely be the standard for this test. This time may change depending on the actual sample matrix encountered in the field.

The primary operator will receive one day's training on the proper use of the instrument particularly for health and safety purposes. The manufacturer's statement on radiation safety is also attached. Each operator will have a gamma film badge service (monthly) and will have the dates and times used logged in the record book specifically kept for this purpose.

FIELD PROCEDURES

1. Calibration of the unit will be provided by three methods.

a. A field calibration based on internal factory standards will be used for developing a working field "screening" calibration used for contaminant assessment. Peak area index will be compared to expected values for "background" levels thus ascertaining contaminated soil. Index values of Cu, Zn, Fe, Mn, Pb, As, and Ni will be recorded manually onto field forms or data for spectral lines will be uploaded onto a microcomputer in the field. Field calibration will be performed at a minimum of three times per day.

b. A second calibration will be made by placing the XRF source over lead or copper foil, recording the peak values, and adjusting as necessary.

c. A third refined calibration curve will be developed by linear regression (and multiple linear regression if necessary to factor out matrix effects) with lab sample splits. This site-specific calibration will be used to estimate metal concentrations from XRF data reported in the final deliverable.

2. Soil samples are placed in a plastic petri dish, compacted to approximate field densities, and leveled off.

3. The XRF is turned on and allowed to stabilize for approximately 15 minutes.

4. The XRF source is placed over the soil in the petri dish.

5. The counting time is selected.

6. The XRF unit is selected for source A or B, and the source unit level is pulled back to expose either the cadmium(A) or iron(B) source, and held for the count interval. A change in tone of the beeps from the XRF unit will indicate when the counting time has elapsed.

7. The Index values for the elements required are recorded on field forms, or the spectral peak is uploaded unto a computer.

NORTHERN ENGINEERING AND TESTING'S
STANDARD OPERATING PROCEDURE
FIELD MEASUREMENT OF REDOX POTENTIAL (Eh)

1. Calibrate instrument in accordance with manufacturer's recommendations daily or more frequently if conditions warrant.

2. Rinse decontaminated glass beaker with approximately 50 milliliters of sample water three times.

3. Rinse Eh electrode with deionized water.

4. Fill beaker with sample water; minimize agitation.

5. Immerse electrode in sample and allow several minutes for the probe to equilibrate with the water.

6. Turn on meter. Obtain reading to nearest ten millivolts.

7. Record reading on standardized field forms or in the field book. Note any problems such as erratic readings.

8. Rinse probe with deionized water and store according to manufacturer's directions.

NORTHERN ENGINEERING AND TESTING'S
STANDARD OPERATING PROCEDURE
GROUND WATER SAMPLING

1. Inspect all sampling equipment for damage upon arriving on-site. Repair equipment as necessary.

2. Decontaminate sampling equipment by scrubbing with brush and 1% Liquinox, solution, rinsing with methanol, and rinsing with deionized water.

3. Sampling domestic wells:

   a. Turn-on household fixture (preferably outside faucet) and allow well to discharge for several minutes. Be certain discharge point is on the well-side of any water conditioning device.

   b. Monitor field parameters periodically during discharge period. When field parameters are within plus or minus five percent over three consecutive readings, the well is ready for sampling.

   c. Fill sample containers and add sample preservatives as appropriate. Do not collect samples through rubber hoses. Samples should be collected directly from hydrant or faucet. Perform field parameter tests.

   d. Complete field forms in accordance with NETSOP-10.

4. Sampling monitoring wells:

   a. Generally, sample monitoring wells from the least contaminated to the more high contaminated well based on previous data or observations. Evacuate monitoring wells with bailer or pump; monitor field parameters for consistency during evacuation process. Remove a minimum of three bore volumes of water from the monitoring well.

   b. Following well evacuation, a clean Teflon or stainless steel bailer and clean Teflon coated stainless steel cable on a reel will be used at each well. Disposable gloves will be used throughout the sampling procedure, and new gloves will be used at each sampling point. Rinse sample containers without preservations with sample water before final collection. Fill two purge-and-trap vials for volatiles analysis slowly so that a positive meniscus forms over the brim. After capping, invert the vials and tap gently to check for air bubbles. If bubbles occur, unscrew cap and add more water; repeat checking until no air bubbles occur.

Label each sample container with project number, unique sample site designator, date and military time, sampler's initials, preservative, and analysis required. Sample packaging and shipping are completed according to NETSOP-09.

c. Field filter sample water in accordance with NETSOP-04 if appropriate. Add sample preservatives as appropriate; fill out field forms in accordance with NETSOP-10.

NORTHERN ENGINEERING AND TESTING'S
STANDARD OPERATING PROCEDURE
SOIL SAMPLE COLLECTION AND HORIZON DESCRIPTION

Soil samples will be collected from the upper inch of the soil profile at locations where there is no or minimal vegetation. At each location, a one foot square board will be placed on the ground and an equal volume of soil from each corner of the board collected. Soil will be scraped from the ground with a plastic trowel and deposited directly onto a plastic sheet where it will be mixed and any clods broken up, and then rolled. At locations where grass or other vegetation is present, the sod root zone will be peeled back with a stainless steel knife and the upper inch of soil will be sampled as described above.

Sample splits will be taken for use as replicates. Samples will be split by mixing and dividing on a plastic sheet or by use of a mechanical soil splitter. Soil samples will be placed in 16-ounce I-CHEM jars with a plastic trowel. After each soil sample, all appropriate paperwork will be completed before moving to the next sample location.

Between sample collection, all equipment will be cleaned thoroughly with a stiff brush and rinsed with distilled water and paper towels. Equipment rinsate samples will be collected after decontamination as a cross-contamination blank at a frequency specified in the Field Sampling Plan (FSP). Bottle blanks, consisting of distilled water used for decontamination placed into a sampling jar, will also be inserted into the sample train at a frequency specified in the FSP.

Soil horizons will be described using standard morphological descriptions in use by USDA-SCS. In addition, the grain size of the soil will be described using the Unified Soil Classification System.